

WHAT IS CLAIMED IS:

1. An immunogenic composition comprising:  
a recombinant product of a *csa* operon and a carrier.
2. The immunogenic composition of claim 1, wherein the recombinant  
5 product of the *csa* operon is CsaA (SEQ ID NO.:2).
3. The immunogenic composition of claim 1, wherein the recombinant  
product of the *csa* operon is at least 95% homologous to CsaA (SEQ ID NO.:2).
4. The immunogenic composition of claim 1, wherein the recombinant  
product of the *csa* operon is CsaB (SEQ ID NO.:4).
- 10 5. The immunogenic composition of claim 1, wherein the recombinant  
product of the *csa* operon is at least 95% homologous to CsaB (SEQ ID NO.:4).
6. The immunogenic composition of claim 1, wherein the recombinant  
product of the *csa* operon is CsaC (SEQ ID NO.:6).
7. The immunogenic composition of claim 1, wherein the recombinant  
15 product of the *csa* operon is at least 95% homologous to CsaC (SEQ ID NO.:6).
8. The immunogenic composition of claim 1, wherein the recombinant  
product of the *csa* operon is CsaD (SEQ ID NO.:8).
9. The immunogenic composition of claim 1, wherein the recombinant  
product of the *csa* operon is at least 95% homologous to CsaD (SEQ ID NO.:8).
- 20 10. The immunogenic composition of claim 1, wherein the recombinant  
product of the *csa* operon is CsaE (SEQ ID NO.:10).
11. The immunogenic composition of claim 1, wherein the recombinant  
product of the *csa* operon is at least 95% homologous to CsaE (SEQ ID NO.:10).
12. The immunogenic composition of claim 1, wherein the carrier is a  
25 composition comprising components suitable for parenteral administration.
13. The immunogenic composition of claim 12, wherein the carrier is a  
composition comprising components suitable for intranasal administration.
14. The immunogenic composition of claim 12, wherein the carrier is a  
composition comprising components suitable for intramuscular administration.
- 30 15. The immunogenic composition of claim 1, wherein the carrier is a  
composition comprising components suitable for enteric administration.

16. The immunogenic composition of claim 1, wherein the recombinant product of the *csa* operon is an expression vector comprising the *csa* operon or a fragment thereof.

5 17. An isolated nucleotide sequence comprising a *csa* operon or a functional fragment thereof.

18. The isolated nucleotide sequence of claim 17, wherein the *csa* operon comprises a *csaA* coding region.

19. The isolated nucleotide sequence of claim 18, wherein the *csa* operon comprises the *csaA* coding region of SEQ ID NO: 1.

10 20. The isolated nucleotide sequence of claim 18, wherein the *csa* operon comprises a nucleotide sequence having at least 95% sequence homology to the *csaA* coding region of SEQ ID NO: 1.

21. The isolated nucleotide sequence of claim 17, wherein the *csa* operon comprises *csaB*.

15 22. The isolated nucleotide sequence of claim 21, wherein the *csa* operon comprises the *csaB* coding region of SEQ ID NO: 3.

23. The isolated nucleotide sequence of claim 21, wherein the *csa* operon comprises a nucleotide sequence having at least 95% sequence homology to the *csaB* coding region of SEQ ID NO: 3.

20 24. The isolated nucleotide sequence of claim 17, wherein the *csa* operon comprises *csaC*.

25. The isolated nucleotide sequence of claim 24, wherein the *csa* operon comprises the *csaC* coding region of SEQ ID NO: 5.

25 26. The isolated nucleotide sequence of claim 24, wherein the *csa* operon comprises a nucleotide sequence having at least 95% sequence homology to the *csaC* coding region of SEQ ID NO: 5.

27. The isolated nucleotide sequence of claim 17, wherein the *csa* operon comprises *csaD*.

30 28. The isolated nucleotide sequence of claim 24, wherein the *csa* operon comprises the *csaD* coding region of SEQ ID NO: 7.

29. The isolated nucleotide sequence of claim 24, wherein the *csa* operon comprises a nucleotide sequence having at least 95% sequence homology to the *csaD* coding region of SEQ ID NO: 7.

30. The isolated nucleotide sequence of claim 17, wherein the *csa* operon comprises *csaE*.

31. The isolated nucleotide sequence of claim 30, wherein the *csa* operon comprises the *csaE* coding region of SEQ ID NO: 9.

32. The isolated nucleotide sequence of claim 30, wherein the *csa* operon comprises a nucleotide sequence having at least 95% sequence homology to the *csaE* coding region of SEQ ID NO: 9.

33. An expression vector comprising a *csa* operon nucleotide sequence or an antigenic fragment thereof.

34. A host cell comprising the expression vector of claim 33.

35. A purified polypeptide sequence expressed from a recombinant *csa* operon or an antigenic fragment thereof.

36. The purified polypeptide sequence of claim 35, wherein the *csa* operon comprises a *csaA* coding region.

37. The purified polypeptide sequence of claim 35, wherein the *csa* operon comprises the *csaA* coding region of SEQ ID NO: 1.

38. The purified polypeptide sequence of claim 37, wherein the *csa* operon comprises a nucleotide sequence having at least 95% sequence homology to the *csaA* coding region of SEQ ID NO: 1.

39. The purified polypeptide sequence of claim 35, wherein the *csa* operon comprises *csaB*.

40. The purified polypeptide sequence of claim 39, wherein the *csa* operon comprises the *csaB* coding region of SEQ ID NO: 3.

41. The purified polypeptide sequence of claim 39, wherein the *csa* operon comprises a nucleotide sequence having at least 95% sequence homology to the *csaB* coding region of SEQ ID NO: 3.

42. The purified polypeptide sequence of claim 35, wherein the *csa* operon comprises *csaC*.

43. The purified polypeptide sequence of claim 42, wherein the *csa* operon comprises the *csaC* coding region of SEQ ID NO: 5.

44. The purified polypeptide sequence of claim 42, wherein the *csa* operon comprises a nucleotide sequence having at least 95% sequence homology to the *csaC* coding region of SEQ ID NO: 5.

45. The purified polypeptide sequence of claim 35, wherein the *csa* operon comprises *csaD*.

46. The purified polypeptide sequence of claim 45, wherein the *csa* operon comprises the *csaD* coding region of SEQ ID NO: 7.

47. The purified polypeptide sequence of claim 45, wherein the *csa* operon comprises a nucleotide sequence having at least 95% sequence homology to the *csaD* coding region of SEQ ID NO: 7.

48. The purified polypeptide sequence of claim 35, wherein the *csa* operon comprises *csaE*.

49. The purified polypeptide sequence of claim 48, wherein the *csa* operon comprises the *csaE* coding region of SEQ ID NO: 9.

50. The purified polypeptide sequence of claim 48, wherein the *csa* operon comprises a nucleotide sequence having at least 95% sequence homology to the *csaE* coding region of SEQ ID NO: 9.

51. A method of generating an immune response, comprising:  
providing an immunogenic composition to a subject, wherein said immunogenic composition comprises a recombinant product of a *csa* operon;  
and

contacting said subject with said immunogenic composition, whereby an immune response is generated in said subject.

52. The method of claim 51, wherein the product of the *csa* operon is the CS4 antigen.

53. The method of claim 52, wherein the CS4 antigen is provided in an acellular composition.

54. The method of claim 52, wherein the CS4 antigen is provided in a cellular composition.

55. The method of claim 51, wherein the recombinant product of the *csa* operon is CsaA (SEQ ID NO.:2).

56. The method of claim 51, wherein the recombinant product of the *csa* operon is at least 95% homologous to CsaA (SEQ ID NO.:2).

5 57. The method of claim 51, wherein the recombinant product of the *csa* operon is CsaB (SEQ ID NO.:4).

58. The method of claim 51, wherein the recombinant product of the *csa* operon is at least 95% homologous to CsaB (SEQ ID NO.:4).

10 59. The method of claim 51, wherein the recombinant product of the *csa* operon is CsaC (SEQ ID NO.:6).

60. The method of claim 51, wherein the recombinant product of the *csa* operon is at least 95% homologous to CsaC (SEQ ID NO.:6).

61. The method of claim 51, wherein the recombinant product of the *csa* operon is CsaD (SEQ ID NO.:8).

15 62. The method claim 51, wherein the recombinant product of the *csa* operon is at least 95% homologous to CsaD (SEQ ID NO.:8).

63. The method of claim 51, wherein the recombinant product of the *csa* operon is CsaE (SEQ ID NO.:10).

20 64. The method of claim 51, wherein the recombinant product of the *csa* operon is at least 95% homologous to CsaE (SEQ ID NO.:10).

65. The method of claim 51, wherein the carrier is a composition comprising components suitable for parenteral administration.

66. The method of claim 65, wherein the carrier is a composition comprising components suitable for intranasal administration.

25 67. The method of claim 65, wherein the carrier is a composition comprising components suitable for intramuscular administration.

68. The method of claim 51, wherein the carrier is a composition comprising components suitable for enteric administration.

30 69. A method of producing a polypeptide product from a *csa* operon or functional fragment thereof, comprising:

providing the *csa* operon in an expression vector;

introducing the expression vector into a host cell, such that a recombinant host cell is produced; and

subjecting to the recombinant host cell to conditions such that a protein from the *csa* operon is expressed.

5           70.    The method of claim 69, wherein the polypeptide product of the *csa* operon is the CS4 antigen.

71.    The method of claim 69, wherein the polypeptide product of the *csa* operon is CsaA (SEQ ID NO.:2).

10          72.    The method of claim 69, wherein the polypeptide product of the *csa* operon is at least 95% homologous to CsaA (SEQ ID NO.:2).

73.    The method of claim 69, wherein the polypeptide product of the *csa* operon is CsaB (SEQ ID NO.:4).

74.    The method of claim 69, wherein the polypeptide product of the *csa* operon is at least 95% homologous to CsaB (SEQ ID NO.:4).

15          75.    The method of claim 69, wherein the polypeptide product of the *csa* operon is CsaC (SEQ ID NO.:6).

76.    The method of claim 69, wherein the polypeptide product of the *csa* operon is at least 95% homologous to CsaC (SEQ ID NO.:6).

20          77.    The method of claim 69, wherein the polypeptide product of the *csa* operon is CsaD (SEQ ID NO.:8).

78.    The method claim 69, wherein the polypeptide product of the *csa* operon is at least 95% homologous to CsaD (SEQ ID NO.:8).

79.    The method of claim 69, wherein the polypeptide product of the *csa* operon is CsaE (SEQ ID NO.:10).

25          80.    The method of claim 69, wherein the polypeptide product of the *csa* operon is at least 95% homologous to CsaE (SEQ ID NO.:10).

81.    A method for generating an immune response in a vertebrate against ETEC, comprising administering to the vertebrate an amount of a polynucleotide operatively encoding at least an immunogenic portion of the *csa* operon and having at  
30   least about 15 nucleotides, or administering a polypeptide encoded thereby.